CLAIMS:

1. A method for performing channel estimation in an orthogonal frequency-division multiplexing system, the method including the steps of:

receiving transmitted pilot symbols from a plurality of transmit antennas;

forming a least-squares estimation matrix from the transmitted pilot symbols;

forming a sparse smoothing matrix approximating a fixed weighting matrix, wherein each row vector in the sparse smoothing matrix contains one or more of the strongest weights in each row of the fixed weighting matrix; and

deriving a channel estimation matrix from the sparse smoothing matrix and the least-squares estimation matrix.

2. A method according to claim 1, wherein the sparse smoothing matrix is defined according to:

$$E_j(k) = \underset{w_j(k,m)}{\arg\max}\left\{\left(\sum_{m=0}^{M-1} \left|w_j(k,m)\right|^2\right) \middle| w_j(k)\right\}$$

where $E_j(k)$ is the row of the sparse smoothing matrix with non-zero terms $w_j(k,m)$ formed from the M strongest weights of the k'th row of the fixed weighting matrix $W_j(k)$; k represents the frequency bin number and j the transmitting antenna number.

3. A method according to either one of claims 1 or 2, wherein repeated pilot symbols preceded and/or followed by a cyclic prefix are transmitted on interleaved sub-carriers from the plurality of transmit antennas.

4. A method according to either one of claims 1 or 2, wherein independent pilot symbols, each preceded and/or followed by a cyclic prefix, are transmitted on interleaved sub-carriers from the plurality of transmit antennas.

5. A method according to either one of claims 1 or 2, wherein a pilot symbol preceded and/or followed by a cyclic prefix is transmitted on interleaved sub-carriers from the plurality of transmit antennas.

6. A method according to any one of the preceding claims, and further including the step of:

selecting a cyclic prefix window length or delay spread approximation length to enable real and imaginary parts of the fixed weighting matrix to contain equal or zero entries.

7. A method according to claim 6, wherein the length of the cyclic prefix window or the delay spread approximation is (1+N/2) or (1+N/4), where N is the length of the Inverse Discrete Fourier Transform used to form the pilot symbol.

8. A method according to any one of the preceding claims, wherein the step of forming a sparse smoothing matrix includes:

calculating a plurality of possible sparse smoothing matrices;

storing the plurality of matrices in a storage device; and

selectively retrieving one of the plurality of possible sparse smoothing matrices from the storage device.

9. A method according to claim 8, wherein the storage device is a look-up table.

10. A method according to either one of claims 8 or 9, wherein the smoothing matrix is selected for retrieval from the storage device according to characteristics derived from the least squares estimation matrix.

11. A method according to claim 10, wherein the characteristics include any one or more of the signal to noise ratio SNR, the root mean square delay spread of the power delay profile τ_{rms} and the delay spread of the power delay profile τ_X.

12. A method according to any one of the preceding claims, and further including the step of:

making coefficients of the fixed weighting matrix real by performing a cyclic shift to locate the channel impulse response symmetrically around zero.

13. A method according to claim 12, wherein the cyclic shift is performed in either the time domain or by an equivalent linear phase rotation in the frequency domain..

14. A method according to any one of the preceding claims, and further including the step of:

using a symmetrically shaped delay spread approximation for the channel estimation.

15. A method according to claim 14, wherein the delay spread approximation is rectangular-shaped.

16. A channel estimator for use in an orthogonal frequency-division multiplexing system, the channel estimator including:

a least-squares estimation unit for forming a least-squares estimation matrix from pilot symbols transmitted from a plurality of transit antennas;

a matrix formation unit for forming a sparse smoothing matrix approximating a fixed weighting matrix, wherein each row vector in the sparse smoothing matrix contains one or more of the strongest weights in each row of the fixed weighting matrix; and

a channel estimation unit for forming a channel estimation matrix from the sparse smoothing matrix and the least-squares estimation matrix.

17. A channel estimator according to claim 16, wherein the sparse smoothing matrix is defined according to:

$$E_j(k) = \arg\max_{w_j(k,m)} \left\{ \left(\sum_{m=0}^{M-1} \left| w_j(k,m) \right|^2 \right) \middle| w_j(k) \right\}$$

where $E_j(k)$ is the row of the sparse smoothing matrix with non-zero terms $w_j(k,m)$ formed from the M strongest weights of the k'th row of the fixed weighting matrix $W_j(k)$; k represents the frequency bin number and j the transmitting antenna

18. A channel estimator according to either one of claims 16 or 17, wherein the matrix formation unit includes:

a storage device for storing a plurality of possible sparse smoothing matrices; and

a matrix selection unit for selectively retrieving one of the plurality of possible sparse smoothing matrices from the storage device.

19. A channel estimator according to claim 8, wherein the storage device is a look-up table.

20. A channel estimator according to either one of claims 18 or 19, wherein the matrix formation unit acts to select the sparse smoothing matrices for retrieval from the storage device according to characteristics derived from the least squares estimation matrix.

21. A channel estimator according to claim 20, wherein the characteristics include any one or more of the signal to noise ratio SNR, the root mean square delay spread of the power delay profile τ_{rms} and the delay spread of the power delay profile τ_{X}.